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Disparities in CD4+ T-Lymphocyte Monitoring Among Human Immunodeficiency Virus-Positive Medicaid Beneficiaries: Evidence of Differential Treatment at the Point of Care

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Abstract

Background—Monitoring of immune function, measured by CD4 cell count, is an essential service for people with Human Immunodeficiency Virus (HIV). Prescription of antiretroviral (ARV) medications is contingent on CD4 cell count; patients without regular CD4 monitoring are unlikely to receive ARVs when indicated. This study assesses disparities in CD4 monitoring among HIV-positive Medicaid beneficiaries.

Methods—In this retrospective observational study, we examined 24 months of administrative data on 2,250 HIV-positive, continuously-enrolled fee-for-service Medicaid beneficiaries with at least two outpatient healthcare encounters. We used logistic regression to evaluate the association of patient demographics (age, gender, race/ethnicity, and language) with receipt of at least one CD4 test per year, controlling for other potentially confounding variables.

Results—Having a history of ARV therapy was positively associated with receipt of CD4 tests. We found racial/ethnic, gender, and age disparities in CD4 testing. Among individuals with a history of ARV use, all racial/ethnic groups were significantly less likely to have CD4 tests than White non-Latinos (African Americans, OR = 0.35, $p<0.0001$; Asian/Pacific Islanders, OR = 0.31, $p=0.0047$; and, Latinos, OR = 0.42, $p<0.0001$).

Conclusions—Disparities in receipt of CD4 tests elucidate one potential pathway for previously reported disparities in ARV treatment. Further qualitative and quantitative research is needed to identify the specific factors that account for these disparities, so that appropriate interventions can be implemented.

Introduction

$CD4^+$ T-lymphocyte (CD4) cell count is a key measure of immune function, and is used to evaluate disease control for individuals with Human Immunodeficiency Virus (HIV) infection. CD4 cell monitoring is one of the most essential and basic services recommended for people with HIV. It is the basis for treatment decisions including initiation of antiretroviral (ARV) therapy, which is recommended for individuals whose immune function has been significantly compromised by the virus [1].

Advances in ARV therapy have reshaped care for people with HIV infection, and are a substantial contributor to increases in average survival time after diagnosis with HIV [2]. Because treatment decisions related to ARV medications are contingent on CD4 cell count, patients who do not receive recommended CD4 monitoring may be unlikely to receive ARVs when indicated and may suffer worse outcomes related to HIV progression.

Previous research has documented substantial evidence of racial/ethnic disparities in access to and quality of care among HIV-positive adults in the US. Several studies have examined equity related to having a usual source of care, receiving treatment for opportunistic infections (OIs) [2], and receiving appropriate ARV medications [2-14]. Moreover, there has been little agreement as to the mechanisms that account for observed disparities [15]. Recent developments in the literature have searched for upstream explanatory factors for observed disparities among HIV-positive individuals, which have been variously attributed to provider attitudes or discrimination [15, 16]; provider knowledge and expertise [16, 17]; patient-provider relationship or communication [18-21]; lack of access to care in general [2, 22, 23]; discontinuity of care [2, 3, 13, 15]; patient knowledge, beliefs, and perceptions [24-29]; and other factors. However, no studies have examined receipt of CD4 tests as a process measure of quality of care for HIV-positive adults, despite their importance in disease monitoring and as a precursor to treatment decisions related to ARVs.

This paper explores whether there are racial/ethnic disparities in receipt of CD4 tests among HIV-positive Medicaid beneficiaries. The findings of this study are informative for policymakers and health care delivery systems to better ensure adequate and equitable access for all HIV-positive adults. In a time when HIV can be treated effectively to prolong life, failures in care delivery that create barriers to ARV access are of critical importance.

Methods

Study Design and Data Source

This is a retrospective cross-sectional observational study of adult Medicaid beneficiaries. Our study period was composed of two years of Medicaid claims and eligibility history data from March 2007 through February 2009, separated into a “prior year” (March 2007 – February 2008) used to compose historical utilization measures as control variables, and a “study year” (March 2008 – February 2009) used to assess the outcome. We constructed member-level utilization and eligibility records from administrative claims and eligibility data. These administrative data were made available for research with IRB approval.

Study Cohort

Identification of HIV-Positive Adults—The study population was HIV-positive Medicaid beneficiaries in one major metropolitan region of one state. To identify HIV-positive adults, we used the maximum available claims history for each individual (up to 36 months long). We applied an algorithm that required a minimum of two instances of HIV diagnosis during the 36 months claims history. The two-diagnosis rule is aligned with a method tested for other chronic conditions using Medicare administrative data [30]. We required at least one of the diagnoses to occur between December 2006 and March 2008, the

period of available data prior to the start of the study year. The inclusion algorithm was based on international Classification of Diseases-9 (ICD-9) codes '042', 'V08', '795.71', and '079.53'.

Additional Inclusion and Exclusion Criteria—The original Medicaid claims file available to us included adults aged 19 to 64 who were enrolled in fee-for-service (FFS) Medicaid and were not dually eligible for Medicare. We further limited the study population to individuals who were continuously enrolled throughout the two years of interest. We defined continuous enrollment as enrollment for at least 11 out of every 12 months with no adjacent gaps in coverage, which is aligned with the measure definitions established by the National Committee for Quality Assurance (NCQA) for the Healthcare Effectiveness Data and Information Set (HEDIS). We then limited the study population to individuals who had at least one outpatient health care encounter during each year of the study period. We used this final inclusion criterion to isolate the factors influencing receipt of CD4 screenings at the point of care, while avoiding any potentially confounding effects from factors that influence access to or use of the health care system at all, as access to care is a previously documented driver of disparities [31]. Finally, we removed individuals who were missing other variables of interest. Our final sample size included 2,250 individuals meeting all inclusion criteria.

Hypothesis

We hypothesized that among continuously enrolled HIV-positive adults in Medicaid, minority beneficiaries were less likely to receive appropriate CD4 tests than White non-Latinos. The hypothesis was based on evidence that minorities have worse access to health services in general regardless of their socioeconomic status [32], and evidence that among HIV-positive adults, access to care and treatment at the point of care may be affected by discrimination, stigma, health beliefs, and social and cultural norms, all of which may vary with race/ethnicity [12, 28].

Conceptual Model

Figure 1 shows our conceptual model describing receipt of CD4 tests among HIV-positive Medicaid beneficiaries. Specific factors that influence receipt of CD4 tests in this population fall into two domains: provider/facility factors and patient factors.

Provider and Facility Factors—We expected provider perceptions, communication skills, and their relationship with patients to influence provision of CD4 screening. The nature of the patient-provider relationship has been shown to be a factor in utilization in general, and specifically in the appropriate use of ARVs for individuals with HIV [2, 3, 13, 15]. Providers who better know and communicate with their patients may be more aware of their health conditions and therefore better enabled to provide coordinated, guideline-concordant care. We examined several index measures of the continuity of the patient-provider relationship, but they did not fit well for the large proportion of the study population with very few outpatient encounters during the study year, so we did not include them in our analysis. We used patient's primary language as a proxy for communication barriers, with English as the reference group. However, patient language is an imperfect

proxy as it is unknown to what extent providers may be bilingual or have access to medical interpretation services.

Provider beliefs, such as perceived patient reliability, have been shown to impact decisions related to care delivery [16, 29]. We used patient demographics (gender, language, and race/ethnicity) as empirical proxies for discrimination, because providers may have conscious or subconscious attitudes about particular groups of HIV-positive individuals. Diagnosis with a behavioral health condition including substance use history was also included as a proxy for discrimination, because providers may treat this population differently.

Failures in delivery of guideline-concordant care may also be related to the characteristics of the provider, such as their practice location, training, or years of experience [16, 17]. We used the practice setting (solo practice versus a group practice setting of some type) as a proxy for provider access to supportive resources. We lacked reliable data on provider years of experience or sub-specialty training.

We also identified the Hospital Service Area (HSA) in which the patient lived as a proxy for any geographic effects that might confound the analysis of the provider-patient relationship. HSAs are geographic areas defined by hospital catchment regions[33].

Patient Factors—We included age, gender, language, and race/ethnicity as proxies for patient health beliefs and cultural norms, self-efficacy, and perception of stigma, because these factors are likely to vary with patient demographics and can be associated with either increases or decreases in utilization [21, 25, 26, 28, 31].

Patient health status/severity of illness and perceived need are important predictors of utilization in general [34], and may impact willingness to consent to treatment. We created proxies for health status/severity of illness based on any history of antiretroviral (ARV) medication use and any history of diagnosis with an opportunistic infection (OI). Treatment guidelines indicate use of ARVs after immune status has declined below a specific level [1, 35]; the occurrence of OIs is similarly an indicator of worsening disease control and immune status. Although we limited the study to beneficiaries with at least one visit during both the prior year and the study year, we also adjusted for the total number of outpatient encounters to control for the patient's total level of engagement with health care.

Finally, patients with greater self-efficacy may be better able to advocate for themselves in the face of provider discrimination or other barriers to care. These patients may also be more aware of treatment guidelines and may be more likely to request specific care. We used prior diagnosis with a mental health or substance use disorder as a proxy for impaired patient self-efficacy. Demographic factors such as gender or age may also partially capture this conceptual domain.

Measure Construction

Dependent Variable—Our dependent variable was whether beneficiaries received any CD4 tests during the study year. To identify CD4 tests, we queried claims data for services rendered within the study year for relevant current procedural technology (CPT) codes.

Using codes 86356, 86359, 86360, and 86361, we flagged individuals who had at least one relevant claim and classified all others as not having received any CD4 test. CD4 tests are recommended at least every four months and more frequently for some patients [36, 37]. However, we required only one CD4 test over 12 months because patients may have received a test immediately before or after the study year and thereby been in very near compliance with the guideline even with only one test during the year of interest.

Independent Variables—Our primary independent variable of interest was race/ethnicity. We obtained this variable, and other patient characteristics including primary spoken language, age, and gender, from the Medicaid eligibility file. Race/ethnicity, language, and gender were self-reported by the beneficiary at the time of Medicaid application. Race/ethnicity was categorized into five mutually exclusive indicators representing the categories available to beneficiaries at the time of enrollment: White non-Hispanic; Black non-Hispanic; Hispanic/Latino; Asian/Pacific Islander; and other. Language was categorized into three mutually exclusive categories: English, Spanish, and other or unknown language (which included Asian languages for which the sample size was small). Age was calculated as of the first date of the study period, using date of birth.

We used historical claims data from the prior year to construct control variables related to utilization of health services, to reduce potential concerns of endogeneity due to reverse causality between utilization-related predictors and the outcome. This lagged technique applies to the following predictors: history of ARV use, OI diagnosis, mental illness or substance use diagnosis, and number of outpatient visits.

We created an indicator for ARV use based on a list of national drug codes (NDCs) for ARV medications, which was obtained from the AIDS Healthcare Foundation (AHF), a Los Angeles healthcare provider specializing in care for HIV-positive populations. We queried the prior year claims for any paid claim for a relevant ARV NDC code. Once patients begin treatment with ARV medications, guidelines generally indicate ongoing treatment except in rare cases of side effects or other circumstances that necessitate lapse of treatment.

We also developed indicators for diagnosis with any OI, and any mental illness or substance abuse diagnosis, both during the prior year. The indicator for OI diagnosis (which included but was not limited to conditions such as Pneumocystis pneumonia, Mycobacterium tuberculosis, and Mucocutaneous Candidiasis) was based on any instance of ICD-9 diagnosis codes for relevant conditions. The list of codes was provided by AHF. The indicator for mental illness/substance abuse was based on any instance of international classification of diseases (ICD-9) diagnosis codes 290 through 319 (inclusive).

We counted the number of outpatient visits for each patient during the prior year and study year. Outpatient visits were defined as claims from the outpatient setting with an Evaluation and Management (E&M) CPT code. We included a variable classifying the number of prior year outpatient encounters as 1-2 encounters, 3-6 encounters, and 7 or more encounters since there was a wide spread in the number of encounters and it was unlikely to have a linear relationship with the outcome; outpatient utilization rate was highly correlated between the prior year and the study year.

Using the outpatient visit history, we identified the most prevalent outpatient provider for each patient during the study period. We classified the provider ID that appeared most frequently in each patient's outpatient visit history as the patient's primary treating provider. Only a small proportion of patients (less than 7%) had two or fewer qualifying outpatient visits during the study year. If the patient saw multiple providers with equal frequency, we selected the final provider seen during the study period as the primary treating provider. We excluded beneficiaries from the study if their most prevalent outpatient provider could not be reasonably expected to provide HIV-related care, such as optometrists or dermatologists.

We categorized each *provider* based on the type of practice setting. We used the name of the billing entity to identify those providers practicing in a group setting, such as a clinic, independent physician association (IPA), medical group, or hospital. In contrast, we classified providers whose billing entity was a specific provider name or clearly represented a solo-practitioner business such as a limited liability company (LLC) as practicing in a solo-practice setting. Using this method, 79% of beneficiaries in the study group had a predominant provider who practiced in a group setting. We eliminated 79 beneficiaries for whom the primary treating provider could not be identified as either solo or group practitioner.

Statistics

As described above, our analysis included individuals who were continuously enrolled in FFS Medicaid and had a minimum of one outpatient health care encounter during each year of the study. We assessed the Pearson correlation between history of ARV use and each variable in a bivariate descriptive analysis. We identified significant differences in population characteristics between patients with and without a history of ARV use (Table 1), and therefore stratified our multivariate analysis by history of ARV use during the prior year. In multivariate analysis, we assessed the association of the independent variables with receipt of CD4 screening. We used two logistic regression models fit separately to patients with and without a history of ARV use during the prior year. We included a random intercept for the patient's HSA of residence to control for unmeasured factors that vary at the geographic level, such as provider supply and access to tertiary care services. Model parameters were estimated using the Glimmix procedure of SAS, Version 9.3 (SAS Institute, Cary, North Carolina). All analyses used a significance cut-off of $\alpha = 0.05$.

Results

There were a total of 2,250 individuals who met study inclusion criteria. Overall, 64.5% of the study population had at least one CD4 test during the 12-month study period (Table 1). The proportion of the population receiving any CD4 test was significantly higher among individuals with a history of ARV use in the prior year (73%), compared to those without a history of ARV use (45%). Other population characteristics are shown in Table 1; all population characteristics differed significantly between those with and without a history of ARV use.

Parameter estimates for the multivariate logistic regression analyses are shown in Table 2. Estimates are displayed as odds ratios, the ratio of the odds of receiving a CD4 screening

relative to that of the reference group, holding constant all other predictors. Significance levels (p-value) for the odds ratio point estimates are also shown.

Among individuals with a history of ARV medication use during the prior year, there were statistically significant racial/ethnic disparities in odds of receiving a CD4 test. All groups had lower odds of being tested compared to White non-Latinos, holding other covariates constant. Our analysis also indicated that, within this group, individuals with a diagnosed mental illness or substance use condition during the prior year had significantly higher odds of receiving a CD4 test.

In contrast, focusing on individuals who did not receive ARV medications during the prior year, racial/ethnic disparities are largely not significant (only African-Americans have significantly lower odds of CD4 testing than White non-Latinos). However, Spanish speakers had lower odds of CD4 testing than English speakers, women had lower odds than men, and compared to adults age 55-64 (the oldest in our analysis), those from 35 to 54 had significantly higher odds of receiving a CD4 test.

Using post estimation techniques, we computed the predicted probability of receiving a CD4 test for the most relevant language and race combinations (Figure 2). Notably, individuals without ARV medication use in the prior year had consistently lower predicted probability of receiving CD4 tests than those who had ARV medications. This finding is concerning, as CD4 monitoring is essential to determine when treatment with ARV medications should be started.

Discussion

We found a low overall rate of appropriate CD4 screening (64.5%) among HIV positive adult Medicaid beneficiaries with continuous enrollment in coverage and demonstrated access to care, indicating an important gap in quality of care for this population. Our criterion for “appropriate” care (i.e., one CD4 test in a 12-month study period) was generous; if more rigorous rules for frequency of CD4 monitoring were applied, a greater proportion of the study population would be found to have not received appropriate care.

Our study indicated that individuals who had already been started on ARV treatment prior to the study year had a higher probability of receiving CD4 tests than those who were not being treated with ARVs. This is a disconcerting finding given that guidelines recommend routine CD4 monitoring prior to initiation of ARV therapy, to support timely treatment with ARVs once they become indicated due to worsening immune function. We are unable to link receipt of CD4 tests or actual clinical status (CD4 level) to initiation of ARV treatment. However, our results highlight the need for additional research regarding the timeliness of ARV therapy initiation.

We also found significant disparities in the probability of CD4 screening according to race/ethnicity, age, and gender, although the factors associated with CD4 screening were different for those with and without a history of ARV use. We could not infer the underlying causes of these disparities due to limitations of our data and the observational nature of our study, and future research should explore the explanatory factors to identify possible

remedies. There are many possible sources of the observed disparities, including factors associated with providers, patients, social determinants, and the health care system [8, 16-21, 24-26].

Ideally, a study of this nature would use clinical data to verify HIV-positive status of the study population because of the potential for miscoding or billing errors in administrative claims data. Since we lacked access to clinical data, it is possible that some individuals who are not infected with HIV may be included in our analysis if there were inaccurate HIV diagnoses in their claims history. However, given our inclusion criteria (requiring at least two instances of HIV diagnoses within a 36-month period) it may be that we have erroneously *excluded* individuals with HIV who have limited utilization of health care either in general or specifically related to their HIV infection. We tested several alternative specifications of the methodology to identify HIV-positive beneficiaries based on claims data; our results were relatively robust to population specification although some estimates lost significance with more stringent population algorithms, which may be due to decreased sample size.

Our hypothesis was focused on gaps in appropriate treatment, which may be more likely experienced by individuals who are disenfranchised from the health care system or otherwise disengaged in treatment. Therefore, by restricting the analysis to beneficiaries with multiple diagnoses of HIV and multiple outpatient visits, we may introduce bias toward the null because we are limiting the study to individuals who have more intensive HIV-related utilization patterns. We sought to balance the dual aims of ensuring the study population included only individuals who are truly HIV-positive while avoiding undue exclusion of HIV-positive individuals who are disengaged from care. However, we would argue that there is a clear need for research to validate a methodology for identifying HIV-positive adults based on administrative data. Such a methodology, if validated, could be useful to health plans, accountable care organizations, or other entities that may rely on administrative data for near-time quality and performance measurement, population management, and other applications.

Our results are not widely generalizable to non-Medicaid enrollees, or to people who lack basic access to the health care system. HIV-positive adults with Medicaid coverage are primarily low-income and disabled and thus different from HIV-positive adults who have other sources of insurance or who are uninsured. Our inclusion criteria also leave out Medicaid enrollees who experienced gaps in enrollment and/or who never had any outpatient encounters during the study years. These individuals are arguably the least connected with care, and are likely to have even lower odds of receiving CD4 tests as recommended by guidelines.

Other limitations of our study are as follows. The administrative data used for our study includes only services for which providers billed, and may be incomplete if providers did not bill for all services rendered. However, there should not be any differential propensity to bill for CD4 tests based on patient characteristics, so this potential limitation is unlikely to explain the observed disparities. We lacked direct empirical measures for some of the concepts of interest in our study, and relied on the same proxies for several concepts in some

cases. While these data constraints may limit the generalizability of these findings, the use of Medicaid administrative data allowed for a detailed analysis of the receipt of CD4 screenings at the point of care among the Medicaid population. Since Medicaid is estimated to cover half of all people with HIV -- and under the Affordable Care Act eligibility will be expanded to many more HIV-positive adults with low income [38] -- the discovery of disparities in this population is noteworthy. We are unable to draw inferences about the sources of observed disparities, and further research is needed to understand the underlying causes of the disparities in CD4 screening observed in this study.

Nevertheless, our findings suggest that attention is required to increase frequency of CD4 screening to improve patient care and outcomes in the Medicaid program particularly among non-English speaking and racial/ethnic minority groups. Potential strategies to increase rates of screening may include disseminating guidelines to providers and raising awareness among patients. Addressing the disparities in CD4 testing based on patient race/ethnicity, age, gender, or primary language may be possible through targeted outreach to specific providers and patients.

Identification of disparities in receipt of CD4 testing both for individuals with and without a history of ARV use helps identify the populations in need of concerted outreach and intervention, but the most effective interventions to remedy the observed disparities may depend on the specific causes of the disparities, and should be the subject of additional investigation. As an initial step, our findings suggest that efforts to improve knowledge of and compliance with treatment guidelines for CD4 testing may be best directed toward patients who are more recently diagnosed or have not yet begun treatment with ARV medications, and toward providers who work in solo practice.

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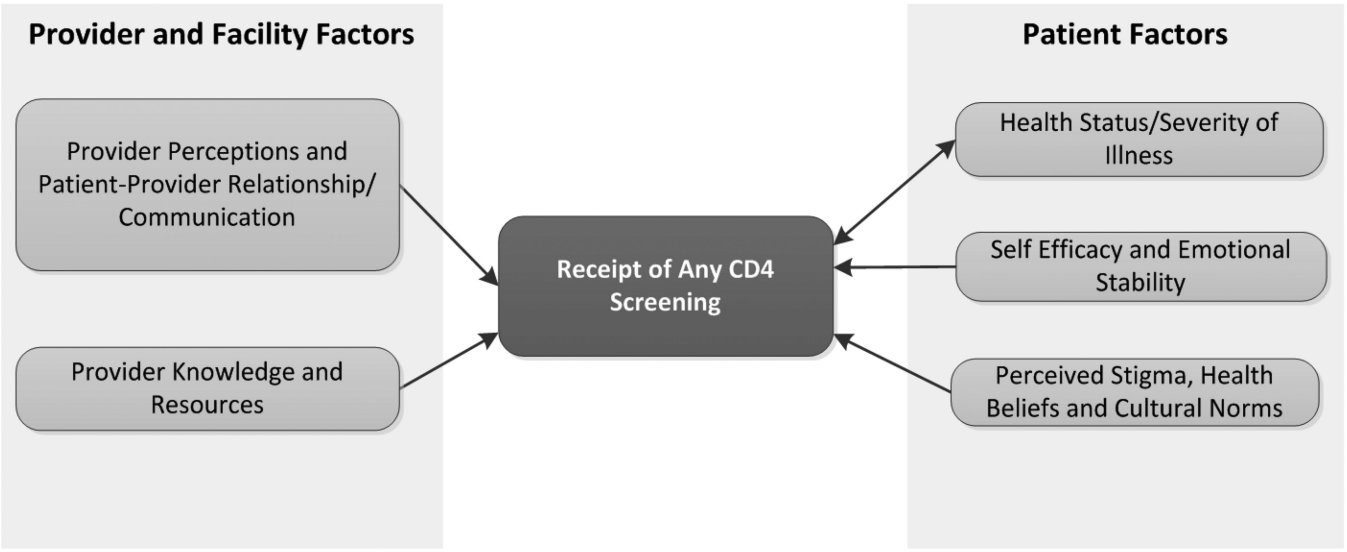

Figure 1.

Conceptual Model for Receipt of Any CD4 Test among HIV-Positive Adults Continuously Enrolled in Medicaid and with at Least One Outpatient Health Care Encounter.

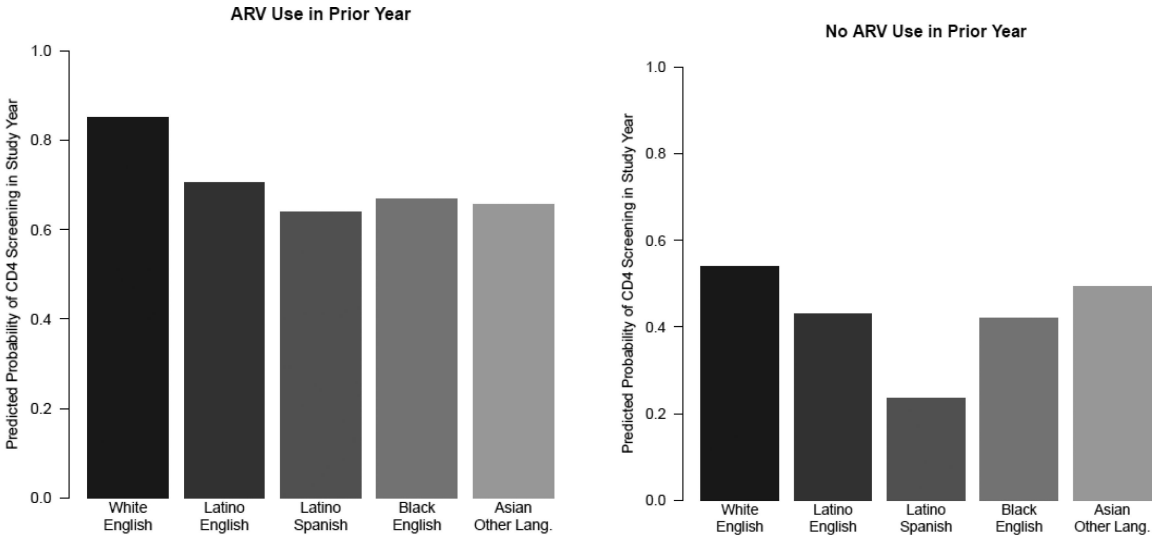

Figure 2.

Predicted Probability of CD4 Screening by Race/Ethnicity and Language, for Individuals with and without ARV Use in the Prior Year.

Table 1

Descriptive Characteristics of the Study Population, Overall and Stratified by Use of Antiretroviral Drugs during the Prior Year.

			Stratified by ARV Use in the Prior Year				
	Total Population		Had ARV Medications		Did Not Have ARV Medications		*P* Value
	No.	Percent	No.	Percent	No.	Percent	
Total Sample Size	2,250	100.0	1,568	69.7	682	30.3	
Any CD4 Test in the Study Period							
No	798	35.5	421	26.9	377	55.3	< 0.0001
Yes	1,452	64.5	1,147	73.2	305	44.7	
Gender							
Male	1,574	70.0	1,149	73.3	425	62.3	< 0.0001
Female	676	30.0	419	26.7	257	37.7	
Age Category							
Age 19 to 34	221	9.8	120	7.7	101	14.8	<.0001
Age 35 to 44	738	32.8	538	34.3	200	29.3	
Age 45 to 54	926	41.2	666	42.5	260	38.1	
Age 55 to 64	365	16.2	244	15.6	121	17.7	
Race/Ethnicity							
White Non-Latino	748	33.2	549	35.0	199	29.2	0.0026
African-American	520	23.1	378	24.1	142	20.8	
Asian/Pacific Islander	775	34.4	504	32.1	271	39.7	
Latino	53	2.4	36	2.3	17	2.5	
Other Race	154	6.8	101	6.4	53	7.8	
Language							
English	1,600	71.1	1,084	69.1	516	75.7	0.0041
Spanish	176	7.8	127	8.1	49	7.2	
Other/Unknown Language	474	21.1	357	22.8	117	17.2	
Opportunistic Infection Diagnosis in the Prior Year							
No	2,010	89.3	1,366	87.1	644	94.4	< 0.0001
Yes	240	10.7	202	12.9	38	5.6	
Mental Health/Substance Use Diagnosis Condition in the Prior Year							
No	1,375	61.1	986	62.9	389	57.0	0.009
Yes	875	38.9	582	37.1	293	43.0	
Predominant Treating Provider Type							
Solo Practitioner	480	21.3	297	18.9	183	26.8	< 0.0001
Medical Group, Clinic, or Hospital	1,770	78.7	1271	81.1	499	73.2	
Number of Outpatient Visits in the Prior Year							
1-2 Outpatient Visits	257	11.4	156	10.0	101	14.8	0.0024
3-6 Outpatient Visits	762	33.9	530	33.8	232	34.0	
7 or More Outpatient Visits	1,231	54.7	882	56.3	349	51.2	

Note: Study population includes HIV-positive adults continuously enrolled in FFS Medicaid with at least one outpatient health care encounter during each year. Adults are identified as HIV positive if they have at least two diagnoses of HIV infection in their available claims history (up to

36 months). Continuously enrolled is defined as enrollment during at least 11 of 12 months during each year in the study period, with no gap longer than 1 month in duration. “ARV medications” is antiretroviral medications.

Table 2

Logistic Regression of Receipt of at Least One CD4 Screening During the Study Year, Stratified by Use of ARV Medications in the Prior Year.

	ARV Medications in the Prior Year		No ARV Medications in the Prior Year	
	Odds Ratio	***P* Value**	**Odds Ratio**	***P* Value**
Intercept	**4.47**	**<.0001**	0.64	0.2698
Female	0.91	0.4973	**0.67**	**0.0381**
Age Category (Age 55 to 64)				
Age 19 to 34	1.73	0.0621	1.11	0.7659
Age 35 to 44	1.23	0.2831	**2.60**	**0.0015**
Age 45 to 54	1.27	0.2009	**2.50**	**0.0013**
Race/Ethnicity (White Non-Latino)				
African American	**0.35**	**<.0001**	**0.62**	**0.0428**
Asian/Pacific Islander	**0.31**	**0.0047**	1.12	0.8588
Latino	**0.42**	**<.0001**	0.65	0.139
Other Race	**0.48**	**0.0089**	1.00	0.9978
Language (English)				
Spanish	0.74	0.2434	**0.41**	**0.0456**
Other/Unknown Language	1.08	0.6527	0.75	0.252
Opportunistic Infection Diagnosis in the Prior Year	0.78	0.1946	0.76	0.5167
Mental Health/Substance Use Diagnosis Condition in the Prior Year	**1.45**	**0.0084**	1.22	0.2979
Predominant Treating Provider - Group/Facility	0.82	0.2393	1.34	0.1776
Number of Outpatient Visits in the Prior Year (1 -2 Visits)				
3-6 Outpatient Visits	0.94	0.7918	0.68	0.1762
7 or More Outpatient Visits	1.28	0.2715	0.91	0.7468

Notes: Study population includes HIV-positive adults continuously enrolled in FFS Medicaid with at least one outpatient health care encounter during each year. . Adults are identified as HIV positive if they have at least two diagnoses of HIV infection in their available claims history (up to 36 months). Continuously enrolled is defined as enrollment during at least 11 of 12 months during each year in the study period, with no gap longer than 1 month in duration. Results are based on multivariate logistic regression using the GLIMMIX procedure in sAs 9.3. The model is stratified by use of antiretroviral (ARV) medications in the prior year and includes a random effect for patient's Hospital Service Area of residence.